



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

TACHIKAWA et al.

Application No.: 09/904,105

Filed: July 13, 2001

For: CHARGED-PARTICLE BEAM IRRADIATOR AND THERAPY SYSTEM
EMPLOYING THE SAME

Confirmation No. 1324

Art Unit: 2853

Examiner: NGUYEN, LAM S

Attorney Dkt. No.: 107292-00023

DECLARATION UNDER 37 C.F.R. 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

I, Mr. Toshiki Tachikawa hereby state and declare as follows:

1. I am a citizen of Japan residing at 2-2-14 Nishinodoi-cho, Niihama-shi, EHIME,
792-0035, Japan.

2. My credentials are as follows:

I have been on the faculty of science at Kyushu University, from which I graduated with a doctorate in Physics, in March 1985. I have been employed by Sumitomo Heavy Industries, Ltd. since April 1985. During my studies at Kyushu University (from 1980-1985), I was involved in experimental studies involving nuclear reactions. In addition, I have performed research and development of axial injection

systems for cyclotrons (1987-1990), and research and development of proton cyclotrons for the exclusive use of cancer therapy (1992-1997).

3. As one of the inventors of the present invention, I am very familiar with the technologies used in beam irradiation including, but not limited to, technologies and practices used in scanning charged particle beams. I am also very familiar with the Office Action dated June 10, 2005, and the references Akiyama et al. (U.S. Patent No. 6,218,675 B1, "Akiyama") and Pu (U.S. Patent No. 6,034,377) cited therein.

4. I have compared the charged particle beam irradiator of the present invention as set forth in the subject application of the claimed invention with the charged particle beam irradiation apparatus of Akiyama and Pu, and provide an explanation below.

Present Invention

As defined in or by independent claim 1, the present invention is directed to a charged-particle beam irradiator comprising: a plurality of scan electromagnets for one direction provided on an entrance side of a final deflection electromagnet to scan a charged-particle beam to expand an irradiation field, and a controller controlling the plurality of said scan electromagnets so that kicks provided by the plurality of said scan electromagnets are combined in said one direction to form a collimated irradiation field at an exit of said final deflection electromagnet.

As defined in or by independent claim 6, the present invention is directed to a therapy system, comprising: a charged-particle beam irradiator, having a plurality of scan electromagnets for one direction provided on an entrance side of a final deflection

electromagnet, to scan a charged-particle beam to expand an irradiation field, and a controller controlling the plurality of said scan electromagnets so that kicks provided by the plurality of said scan electromagnets are combined in said one direction to form a collimated irradiation field at an exit of a final deflection electromagnet to irradiate an affected part with a charged-particle beam.

5. The principle of the present invention for forming a collimated irradiation field at an exit of the final deflection electromagnet is different from the formation of a beam in a combination of Akiyama and Pu. As such, I hereby declare that the modification suggested in the Office Action dated June 10, 2005, that is, the modification of Akiyama by the Pu reference cannot provide a parallel beam. Specifically, the combination of references cannot provide the claimed collimated irradiation field at an exit of the final deflection electromagnet as recited in claims 1 and 6.

Akiyama

The two scanning electromagnets 100, 110 of Akiyama deflect a beam in two orthogonal directions, to scan the beam in a two-dimensional plane, not in one direction. The first scanning electromagnet 100 of Akiyama deflects the beam in an X direction parallel to the deflection plane (X-Z plane) and the second scanning electromagnet 110 deflects the beam in a Y-direction. See column 5, lines 44-54 of Akiyama. The two scanning electromagnets 100, 110 are disposed to work in two different directions (in the X- and Y-axes), not in one direction as recited in claims 1 and 6. Therefore, kicks by the two scanning electromagnets 100, 110 in Akiyama are not combined in the claimed one direction to form a collimated irradiation field, as recited in claims 1 and 6.

Pu

The scanning electromagnets 33 and 35 in Pu are used to expand a beam in one and the same direction. The scanning electromagnets 33 and 35 in Pu must be rotated around a rotating axis 37 to irradiate in a two-dimensional plane. See column 4, lines 15 and 16, and Figs. 3 and 4 of Pu. As shown in Fig. 3 of Pu, the first scanning electromagnet 33 diverges incident beam 31, and then, the second scanning electromagnet 35 converges the diverted beam to obtain the parallel beam shown in the Fig. 3.

If Akiyama and Pu are combined, then the resulting beam of Akiyama would be diverged in the X-direction by the first scanning electromagnet 33 and converged in the Y-direction by the second scanning electromagnet 35. Furthermore, even if the second scanning electromagnet 35 is placed upstream of the bending electromagnet 9 in Akiyama, the second scanning electromagnet 35 can only converge the incident beam, but cannot form a parallel beam.

Therefore, combining the cited references to arrive at the invention of claims 1 and 6 would not be obvious to me or to one of ordinary skill in the art. As evidence that combining the cited references in this way would further not produce the claimed collimated irradiation field, I provide herein, physical evidence that shows that the beam in Akiyama would converge and would not form a collimated irradiation field if the scan electromagnets of Pu are combined with the beam of Akiyama.

In the Office Action dated June 10, 2005, the Examiner stated:

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to modify the charged particle beam irradiation apparatus disclosed by Akiyama et al. such as replacing the plurality scan electromagnets and relating components by the ones having kicks are combined

in one direction as disclosed by Pu to form a collimated irradiation field at the entrance side of the final deflection magnet in order to produce a collimated irradiation field at the exit side of the final deflection magnet. The motivation of doing so is to produce a uniform magnetic field wherein the directions of the magnetic lines of forces are opposite to each other and the strength and the length of the effective magnetic field is the same as taught by Pu (column 4, lines 8-15).

See page 3, lines 7-15 of the Office Action. However, the Examiner's understanding, as set forth in the Office Action, is physically and theoretically inconsistent with the actual result of combining of Akiyama and Pu. Referring to the attached Fig. A, if beams (A, B) are parallel at the entrance side of the final deflection magnet, they are not parallel at the exit side of the final deflection magnet. Specifically, an outside passing beam A is more bent than an inside passing beam B, because the beam A travels a longer distance L_a than L_b of the beam B. Namely, the beam A is more bent than the beam B, because the beam A is more influenced by the magnetic field of the final deflection magnet than the beam B.

In this case, by replacing the plurality of scan electromagnets 100, 110 and related components in Akiyama with the scan electromagnets 33, 35 of Pu, any collimated irradiation field that could be formed at the entrance side of the bending electromagnet would not continue to be collimated at an exit side of bending electromagnet.

Accordingly, claims 1 and 6 are not obvious to me or to one of ordinary skill in the art in light of the cited references.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements

and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Signed this 31 day of October, 2005 (MONTH/YEAR)

Toshiki Tachikawa (NAME)

Toshiki Tachikawa